

ORDA Installation Notes & Lessons Learned

Introduction – As one of the first ORDA sites installed during full deployment, the Lubbock, TX WFO found much of the preliminary information and pre-installation check-off documents sent to the site to be rather high level. In the opinion of site personnel, installation notes and “lessons learned” should be passed along to all WSR-88D electronics technicians in an effort to avoid repeating common mistakes. Hopefully, this exchange of information will make the ORDA transition and installation less difficult for everyone involved.

Pre-installation Preparation – Based on the Lubbock personnel’s installation experience and their conversations with the ORDA team and ROC Hotline, many of the problems encountered during ORDA installation stemmed from the execution of site pre-installation preparation. The pre-installation check-off document does not deal with many of the low-level preparations necessary to avoid problems and delays that could require rescheduling the site installation. Areas of note include:

RDA Shelter Preparation – Ensure the RDA shelter is clean and uncluttered to allow the installation team as much room as possible for their equipment, tools, and supplies. (One possibility is to temporarily transfer equipment to the TPS shelter.) Also, clean the tops of the UD4 and UD5 cabinets to ease the re-cabling, drilling and punching of new holes, and cut-outs in the cabinet tops. The floors should be clean as well, because team members will be lying on the floor to remove and modify the UD4 power supplies.

Flat, horizontal work space will be at a premium. It may be beneficial to have a folding table available to accommodate the many notebooks, manuals, and tools that will be used during installation. Also, have a few stools or chairs available. They will be very handy when reviewing manuals, schematics, etc.

One important component of the pre-installation preparation, which is not mentioned in the preliminary information or check-off document, concerns the RDA Cooling Efficiency System (dated November 20, 2000). The ducting for this modification runs directly under FL3 (1FL3), which is mounted on the ceiling directly above the UD5 cabinet. A clearance of at least 4-inches is required to access the plate at the bottom of the filter, as well as, removing a cable. If there is not a 4-inch clearance, a local air conditioning contractor will be required to remove the ducting to allow the ORDA Installation Team to perform necessary work on the filter. It should be noted the ductwork positioning may be different at each site, due to local fabrication and installation of the parts.

NOTE: It may be necessary to reschedule ORDA installation at sites without proper ductwork clearance.

During pre-installation check-off, pay close attention to the position of the DAU (UD5A3) panel. If the panel is too low, it must be relocated to meet the required ORDA clearance specification. The DAU at Lubbock was found to be located too low and was moved to a higher position in the rack. If the DAU must be moved, it is the responsibility of the site personnel to move the

equipment, not the ORDA installation team. A delay in the very tight installation schedule may take place if the DAU is not in the proper location at the time of the installation team's arrival. Ensure that all shelter lighting is in working order. The installation team will need plenty of light. This will make the installation less difficult and reduce the number of installation errors – especially cabling errors considering the magnitude of this configuration change.

Performing a backup of the site adaptation data and sending the tape to the ROC with a request for a printout of the tape is highly recommended. Doing this as soon as possible will hopefully allow the site personnel to have the information in-hand prior to ORDA installation. Having a complete adaptation data printout will be extremely important and a time-saver during the critical calibration phase of the installation. If there isn't time to send a tape to the ROC and receive a printout of the latest adaptation data and calibration settings, use the last available adaptation data printout and make pen & ink changes and make this information available to the INCO team.

Calibration – System calibration will perhaps be the most important aspect of the pre-installation preparation. The ORDA system pre-check list will contain the following:

- Run test attenuator calibration;
- Receiver/Signal Processor calibration; and
- Perform receiver diagnostics

The Lubbock site personnel found this list to be the bare minimum and insufficient. For the best data, perform a complete and extensive calibration of the entire RDA. This is a lot of work and goes beyond the ORDA system pre-checklist, but it will prove to be time well spent to ensure proper calibration and RDASOT passes all receiver subtests. When performing the receiver subtest, take the time to look at the measured and expected values along with the deltas; adhering to the “pass/fail” criteria is not sufficient. It is to the site's advantage if the deltas are less than .5db on these subtests. Although the Lubbock receiver subtests passed, their subset 9 had a delta of 1.5db. This technically passed the test, it also indicated the need to re-measure the losses in the 4A24 2-position diode switch, thus causing another delay.

The installation team commented on the commonly encountered problem of high receiver noise temperature. The receiver noise temperature should be below 500. Although, it is sometimes rather easy and straight-forward to use the R-12 procedure to locate the problem, it is also common that determining these noise sources can be difficult, too. HINT: When measuring the noise floor with the progressive termination (using the R-12 procedure), wiggle the cables associated with the measured module or unit. If the meter reading jumps, the “bad” has been located (this is common in the swing-out door assembly). It may seem like wasted time to troubleshoot and work on the swing-out door assembly that will be removed and discarded with the ORDA installation. However, the field office will be short-changed if the noise problems aren't resolved and a good calibration completed.

It is the site personnel's responsibility to ensure the ORDA team encounters no surprises upon arrival. Do not have any illusions that the ORDA team will troubleshoot noise temperature problems, or any other problems, for that matter. The ORDA team members are not WSR-88D

Electronics Technicians and if they encounter a problem that will preclude the ORDA installation process, they will require the site personnel to correct the problem before the installation progresses. If the problem is serious enough to delay the installation for several hours, there is a genuine risk that the site installation will be delayed until other scheduled installations have been completed.

If troubleshooting or calibration help is needed, call the ROC Hotline and explain the problem. They will do all they can to help and hopefully avoid the need for rescheduling the installation. The ROC is aware of problems in the field that can impact the aggressive ORDA schedule, and if necessary, can send someone to the site to help resolve these problems prior to ORDA installation.

Technical Manuals & Laminated Flow Diagrams – Lubbock personnel found it essential to have the tech manuals on hand prior to ORDA installation. The need for the manuals was immediate for some of the problems encountered during installation, procedures for performing system administration, and other technical information. However, in the initial distribution of the EHB 6-515 manual, the cover sheet was falsely labeled as XEHB-6-526. Simply remove the cover sheet that states XEHB-6-526 and discard that page. The remainder of the manual is the correct EHB 6-515. This error was identified and corrected while preparing the Tech Manuals box for shipping.

Unfortunately, the large flow diagrams that most sites laminate and hang on the wall inside the RDA shelter and use for troubleshooting was not available at the Lubbock site prior to ORDA installation. However, the ROC will ship these flow diagrams to all sites one week prior to INCO.

Software Note 79 – The site should have the Part-1 of Software Note 79 installation completed and tested via the loop-back plug sent as part of the Modification Note package. The Lubbock electronics technician does not think the loop-back plug included in the modification package is a RJ-45 wrap plug as labeled, but rather a RJ-48 wrap plug. He feels a “standard” RJ-45 wrap plug as used on an Ethernet uses pins 1, 2, 3, and 6. This works on numerous networking devices within a LAN. The wrap plug sent with the Modification Note uses pins 1, 2, 4, and 5, which he says is the wiring standard used for the TELCO side of the CSU - RJ-48. He would like it known that site electronics technicians should not use a RJ-45 loop-back wrap plug they may have in their “drawer of goodies,” to perform the test because it will fail. This will avoid wasting time troubleshooting a problem. Simply utilize the wrap plug supplied with the modification package.

Side Note: This loop-back is performed at the TELCO side of the Verilink-2100 CSU connected to the router. This checks the WAN connection to the TELCO side. If a wideband outage is experienced and site technicians are able to perform this test successfully at the RPG, and are able to loop-back at the RDA site of the connection, the problem is probably with the local TELCO. The RJ-48 may be a good troubleshooting aid and should be stored in a safe place.

Taking the time to properly prepare the site equipment, documentation and environmental conditions for pre-installation can help prepare for intense work and aid in avoiding major problems and embarrassing delays.

Arrival of the Team – The ORDA INCO team will contact the WFO before noon on Sunday to confirm there are no current facility or weather problems that could impact the ORDA installation scheduled for the following day. If the INCO team cannot contact the WFO, the site electronics technician will be contacted. If conditions exist that may affect the installation, the INCO team will contact the ORDA management team to discuss the issue and determine whether the installation shall proceed or be postponed.

Working with the Team – The site electronics technician's job is three-fold during the ORDA installation: a) to witness and observe the installation process from beginning to end; b) provide answers to the INCO team's many questions, and c) correct any problems that may arise.

As an observer, don't hover over the installation team, but make note of how the installation is progressing. However, verify that all tasks on the INCO check list are completed properly. One major benefit of watching the ORDA installation is gaining knowledge in regard to cabling of the new system.

Please remember, if a problem stemming from the legacy radar develops, which precludes the INCO team from continuing the installation, it is the electronics technician's responsibility to correct the problem. The INCO team will not be responsible for troubleshooting these problems. The INCO team will discontinue work until site personnel correct the problem. Therefore, proper pre-installation preparation, as well as, continual site personnel oversight is extremely important to avoid delays and possible installation re-scheduling.

When Problems Occur – Due to the complexity of the ORDA installation, problems are certain to arise – whether they be from mistakes made during installation (such as wiring or cabling), or those exposed due to site individuality. No matter the cause, it is important to resolve the problems as quickly as possible in order to minimize delays and possible overtime. It is the overall common goal to complete the installation properly and on time.

Certainly each site will encounter its own types of difficulties, however, the following are some of those experienced during the Lubbock ORDA installation.

- During the calibration phase of the ORDA installation, the INCO team measured a parameter which was outside the specified limits accepted by the program. Upon reviewing the flow diagram, the site electronics technician decided to check the path to the 4A29 RF Log Amp Detector back through the 2-position diode switch 4A24, 7-bit RF Test Attenuator 4A23, 4-position Diode Switch 4A22, and back to the RF Generator 4A1. Extensive measurements were made with bewildering results. The calibration process was halted and hours were spent troubleshooting the problem. Finally, it was noticed that the control cable exiting the top of the cabinet was not making a complete connection – the pins were making only partial contact. Once the cable was reconnected and tightened, the problem disappeared. Unfortunately, many hours were lost

troubleshooting this problem, causing everyone involved to make up the lost time working late into the evening.

- Another lengthy delay occurred when viewing the RF transmitted pulse for setting up the RF bracketing. Upon first inspection, the presentation on the oscilloscope was absolutely horrible. The electronics technician set about adjusting the transmitter, because the installation couldn't continue until the transmitted pulse was corrected. After spending quite a bit of time adjusting the transmitted pulse and klystron cavities, it was discovered that the oscilloscope was mistakenly set to 1M Ω impedance rather than the required 50 Ω , as designated in the installation procedure. Once the oscilloscope was terminated in the proper impedance, the waveform appeared correctly. Much time was wasted due to "operator error."
- The last, and perhaps most time consuming problem was the discovery that the Lubbock elevation drive motor was going bad, as indicated by the inability to accurately tune the DCU in the elevation. This development was bewildering, as the motor had been recently replaced and there were indications that the tachometer feedback was erratic and running too high. The DCU had recently been aligned with no apparent problems. Site technicians lost precious time with the DCU - cleaning slip rings, replacing all the signal contactors on the slip rings, and finally the motor itself. The site experienced no real problems running with the legacy, but with ORDA's ability to detect problems not detectable by the legacy system, it would not run and continually gave Forced INOP elevation alarms.

The point of providing these examples is to offer a clear picture of the many unexpected problems that may occur during ORDA installation. These unexpected problems, for which not there is no time allotted in the ORDA installation schedule, causes the installation to cease until the problems are corrected. The best way to minimize delays is for site personnel to perform a thorough pre-installation preparation and be on site during the ORDA installation.

Day by Day Installation Breakdown (from the electronic technician's point of view) –

Sunday – Since the ORDA INCO team will be contacting the WFO before noon on Sunday to confirm the ORDA installation scheduled for the following day, the site electronics technician should make himself available to answer any questions and provide information about the facilities as needed.

Monday – Start the workday as early as possible. The Lubbock staff started work at 7 am every morning, and worked a minimum of 10 hours each day. The INCO team preferred to have the in-briefing at the RDA with site personnel. The MIC, ESA and other interested parties may wish to attend. Be prepared to give the INCO team control of the radar as soon as possible. (The Lubbock electronics technician was told that if the INCO team was not given access to the RDA by noon, they were to call their upper management for a possible re-schedule of the installation.)

The INCO team will note the legacy RDA parameters, verify calibration, review site measured deltas, expected values of site paths, in addition to receiver noise temperature and SYS-CAL. They will perform baseline checks by running Sun-check, RDASOT, performing all receiver

subtests, and noting adaptation data parameters. Be very forthright with the reporting of pre-installation checks, because they will be rechecked by the INCO team.

While this is taking place, another INCO team member will inventory the equipment shipped to the site. Seven boxes will be shipped to the site, which may be stored in the TPS shelter for easy access, yet allowing working room inside the RDA shelter.

Note: Single channel sites will receive one pallet with seven ORDA kit boxes; dual channel sites will receive two pallets – one with seven boxes and one with six. Shipments to most sites will also contain an additional box containing Technical Manuals.

The next step will consist of disassembling the UD4 and UD5 cabinets. Much of the contents will be removed and piled outside the RDA shelter. Make sure to turn off the transmitter high voltage, but not the AUX power, before handling the removed cabinet parts.

Tuesday – The disassembling phase continues and preparations begin for installing new cabling and equipment. Quite a bit of drilling and use of a knock-out tool, especially in the top of the UD4 and UD 5 cabinets will occur. This is an excellent time to strip down the old swing-out door and collect all the excess legacy parts for disposal. The Lubbock site placed their parts in an office where two pallets were ready for packing. Use the large boxes that contained the new ORDA parts, place the large boxes on the pallets and carefully stack your old part in them as efficiently as possible. The Lubbock pallets were set up in an office because the RDA site had gravel access, which prevented the use of a pallet jack. (The legacy disposal plan mentions this requirement.)

On Tuesday, the INCO team will begin installing the new cables and some of the ORDA equipment. Pay careful attention to this portion of the installation to gain a good understanding of the cabling layout, equipment, and the ORDA installation from the ground-up. Time permitting, the second part of Software Note 79 can be accomplished, as well as, the loop-back test with the RJ-48 wrap plug. Accomplishing these tasks now will free the electronics technician for the upcoming, fast paced installation and calibration phase, which will require his continual presence at the RDA site.

Wednesday – The INCO team should complete the ORDA installation on Wednesday. Observe the installation with diligence, and thoroughly, and carefully, inspect the cabling. If errors are discovered, tactfully bring this to the INCO team's attention.

On Wednesday afternoon, the system will probably be powered-up and the software loaded for a preliminary evaluation of the ORDA installation. Expect to receive alarms and errors; be prepared to perform troubleshooting efforts at this time. Also, remember much of the adaptation data is missing and the system is not yet calibrated. Ensure the wideband is disconnected to avoid sending erroneous products to the RPG. The Lubbock site connected briefly to the RPG to verify the system would connect and sync-up. They also allowed the system to run in standby mode overnight to allow the system to warm-up and stabilize before starting the calibration phase early Thursday morning.

Thursday – As this is the day the system is calibrated, it would be a good idea for the site electronics technician to be on-site at all times. Lubbock encountered problems immediately upon beginning the calibration process. They wasted a lot of time dealing with cabling errors and test equipment with erroneous settings.

Friday – If all troubleshooting has been completed, the Sun-check will be performed. If it is successful, the remainder of the day will be spent making adjustments and running tests, site clean-up, and preparing to ship the pallets of legacy parts. The wide-band will be reconnected and synced-up with the RPG. (The Lubbock site suggests re-booting the RPG, as they experienced complaints of missing VAD Wind Profiler information, which was corrected following the RPG re-boot.) If all goes well, the out-briefing will take place sometime late Friday afternoon.

Summary & Closing Comments – The out-briefing is a good time to discuss “nuts & bolts” issues with the installation team, who are extremely knowledgeable about the ORDA system. Don’t waste this excellent opportunity to ask questions and learn as much as possible about the new system

This information has been provided in hopes of helping other sites avoid some of the pitfalls experienced by the Lubbock staff. It is hoped that site electronics technicians will “take to heart” the five main points of this paper: 1) ensure thorough pre-installation preparation has been performed; 2) be available on Sunday and ensure the facility is prepared for ORDA INCO on Monday morning; 3) have honest system readings to provide the INCO team (RDA parameters, calibration, site measured deltas, values of site paths, receiver noise temperature, SYS-CAL, etc.); 4) monitor the ORDA installation and be prepared to troubleshoot problems as they arise; and, 5) take advantage of the opportunity to ask questions concerning the ORDA system before the installation team departs.

Please visit the following website to read the original, unedited version of this paper, and for current ORDA INCO status and updates:

<https://www.orda.roc.noaa.gov/Restricted/logon.aspx?ReturnUrl=%2frestricted%2fDefault.aspx>

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